NOISE IN ARMY AVIATION

Terminal Learning Objective

- Manage the effects of noise in Army aviation
- While performing as an air crewmember
- In accordance with FM 3-04.301, AR 40-501 & DA PAM 40-501

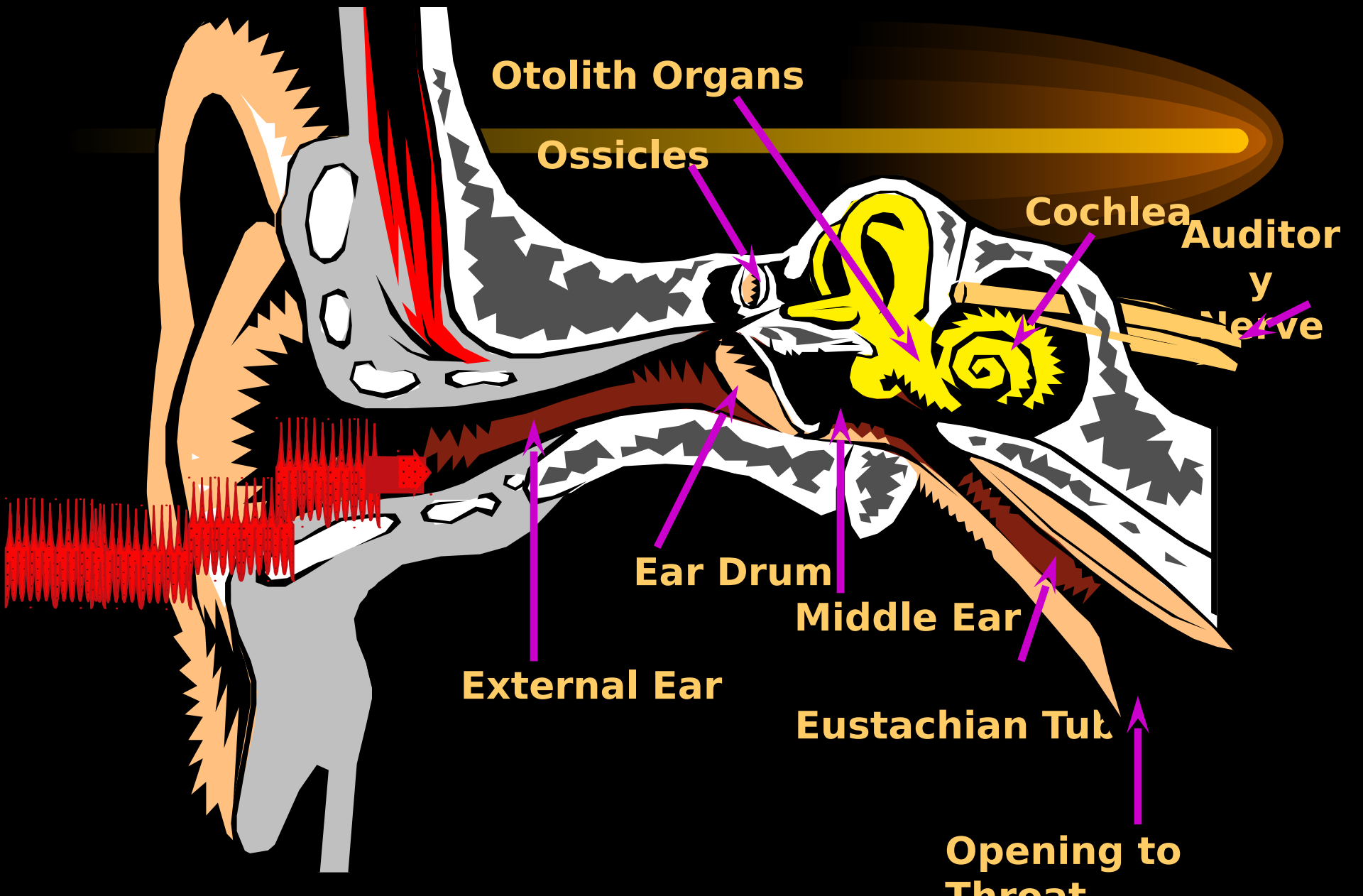
ELO #1

- ACTION: Select the definition of sound.
- CONDITION: From a list.
- STANDARD: IAW FM 3-04.301 (FM 1-301).

Sound

- Produced when an object or surface vibrates rapidly
- Transmitted through any elastic substance such as air, water, or bone.
- Density of the substance determines the speed at which the sound and pressure waves will travel.

Perception of Sound



Receptors of Sound

- Detect fluid movement in the cochlea
- Transmit electrical impulses to the brain where sound is interpreted

Damaged Hair Cells

Damaged hair cells in the various bundles means loss of sound perception

Long Term Hair Cells Damage

Prolonged, unprotected exposure to noise could cause irreversible damage.

QUESTIONS

Noise

Sound that is loud

Unpleasant

Unwanted

Effects of Noise

- Non-auditory effects

  Annoyance
  Fatigue
- Speech interference
- Hearing loss

QUESTIONS ???

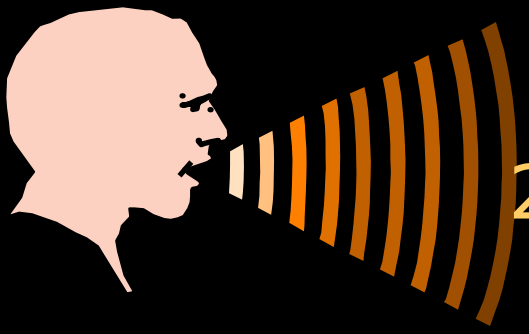
Noise Measurement

Frequency

- Gives sound the quality of pitch
- Number of times per second the air pressure oscillates
- CPS = Hertz (Hz)

Frequency Ranges

20 To 20,000 Hz



200 TO 6,800 Hz

Speech intelligibility 300 to 3,000 H

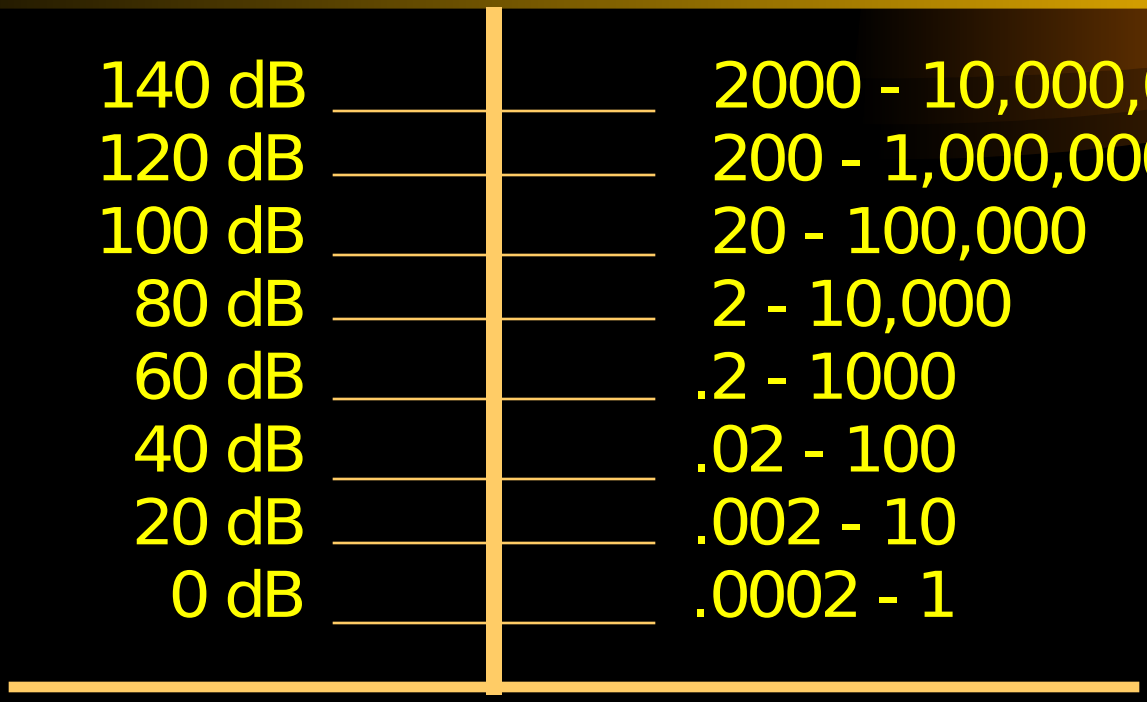
Intensity

- A measure that correlates sound pressure to loudness
- Measured in Decibels (dB)

Decibel (dB) Levels

- 0 dB - Threshold of hearing
- 65 dB - Average human conversation
- 85 dB - Damage-risk noise limit
- 120 dB - Threshold for discomfort
- 140 dB - Threshold of pain
- 160 dB - Ear drum rupture

Sound Pressure



- Sound pressure increases with more intense noise
- 20 dB increase equals pressure increase of 10 times

Duration

Time of exposure

Steady Noise

- Continuous noise at high intensity
- Wide range of frequencies
- Most encountered in Army aviation
- Originates from engines, drive shafts, transmissions, rotors and propellers

Impulse Noise

- Explosive noise
- High intensity with low duration
- Measured in milliseconds with less than 1 second in duration

Damage Risk Criteria

The Surgeon General has established 85 decibels as the maximum level of continuous unprotected exposure to steady-state noise for 8 hours

Army Noise Exposure Criteria

Maximum Exposure Per Day (HR)	Exposure Level (dB)
8	85
4	90
2	95
1	100
30 min	105
15 min	110

QUESTIONS ???

TYPES OF HEARING LOSS

Conductive Hearing Loss

- Defect or impediment in the external or middle ear.
- Impede with the mechanical transmission of sound to the inner ear.

Sensorineural Loss

- When cochlea is damaged
- Most frequently produced by noise
- Occurs in the higher frequencies first
- Could be associated with aging (Presbycusis)

Mixed Hearing Loss

- Combination of conductive and sensorineural loss.
- Example: A crewmember with a middle ear infection (conductive) and high frequency hearing loss (sensorineural).
- One treatable, the other one is not.

Acoustic Trauma

- Sudden and could cause hearing loss
- In excess of 140 dB
- From impulse noise (blast / gunfire)

Temporary Threshold Shift (TTS)

- Single exposure to high level noise
- May last for few minutes / hours
- Depends upon frequency, intensity, and duration of the noise
- Recovery when noise is removed, usually complete

Permanent Threshold Shift (PTS)

- If continued for 15 hours, eventually permanent loss is induced
- No recovery when exposure is terminated
- TTS’s could become permanent (cannot be predicted)

Danger Signals

- Prolonged ringing after exposure
- Interference with normal conversation

QUESTIONS ???

Characteristics of Noise Induced Hearing Loss

- Insidious and undetectable
- Noise intensity below 140dB but above 85dB
- Physical pain not evident
- Initially higher frequencies affected (3000 to 6000 Hz)

Audiograms

- Used to determine hearing loss
- Your first audiogram is a reference
- Considered normal if hearing thresholds are 20 dB or less for all frequencies tested

Audiometric Hearing Levels

Frequency Tested (Hz)	500	1,000	2,000	3,000	4,000	6,000
Class 1,1A	25	25	25	35	45	45
Class 2,3,4	25	25	25	45	55	65

REFERENCE AUDIOGRAM

ZIP CODE/APO

DOD COMPONENT
A - ARMY
N - NAVY
F - AIR FORCE
M - MARINES
I - OTHER DOD ACTIVITY

SERVICE COMPONENT
R - REGULAR
V - RESERVE
G - NATIONAL GUARD
I - OTHER

PERSONAL DATA

SSN

LAST NAME - FIRST NAME - MIDDLE INITIAL

SEX
M - MALE
F - FEMALE

DATE OF BIRTH
year month day

PAY GRADE, UNIFORMED SERVICES

GRADE, CIVILIAN

SERVICE DUTY OCCUPATION CODE

MAILING ADDRESS OF ASSIGNMENT

LOCATION - PLACE OF WORK

DUTY PHONE

Reference Audiogram

AUDIOMETRY

1. REFERENCE ESTABLISHED PRIOR TO INITIAL DUTY IN HAZARDOUS NOISE AREAS
2. REFERENCE ESTABLISHED FOLLOWING EXPOSURE IN NOISE DUTIES
3. REFERENCE RE-ESTABLISHED AFTER FOLLOWUP PROGRAM

HEARING THRESHOLD LEVELS OF TEST FREQUENCIES RE: ANSI S3.6

LEFT EAR						RIGHT EAR					
500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
00	00	15	10	00	10	00	05	10	15	20	10

DATE OF AUDIOGRAM
year month day

DAY OF WEEK
1-SUN 2-MON 3-TUES 4-WED 5-THURS 6-FRI 7-SAT

MIL-TIME (GMT)

HOURS SINCE LAST NOISE EXPOSURE

ENT PROBLEM AT TIME OF TEST
1 - NO 2 - YES 3 - UNKNOWN

EXAMINER

LAST NAME - FIRST NAME - MIDDLE INITIAL

TRAINING CERT. NO.

SSN

SERVICE DUTY OCCUPATION CODE

OFFICE SYMBOL

AUDIOMETER

TYPE
1-MANUAL
2-SELF-RECORDING (automatic)
3-MICROPROCESSOR

MODEL

MANUFACTURER

SERIAL NUMBER

LAST ELECTROACOUSTIC CALIB DATE
year month day

PERSONAL HEARING PROTECTION

TYPE USED
1-SINGLE FLANGE (V51R)
2-TRIPLE FLANGE
3-HAND FORMED EARPLUGS
4-EAR CANAL CAPS
5-NOISE MUFFS
6-OTHER

EARPLUGS ISSUED
1-NO 2-YES 3-PREVIOUSLY ISSUED

SIZE EARPLUGS
R L
1-XS 2-S 3-M 4-L 5-XL

DOUBLE PROTECTION USED
1-NO 2-YES

GLASSES WORN (including goggles)
1-NO 2-YES

FREQUENCY GLASSES WORN
1-ALWAYS 2-SELDOM 3-N/A

REMARKS

HEARING CONSERVATION DATA

(This form is subject to the Privacy Act of 1974 - use Blanket PAS - DD Form 2005)

1. ZIP CODE/APO/FPO/PAS

2. DOD COMPONENT: A

A - ARMY, N - NAVY, F - AIR FORCE, M - MARINE CORPS, 1 - OTHER

3. SERVICE COMPONENT: R

R - REGULAR, V - RESERVE, G - NATIONAL GUARD, 1 - OTHER

4. SOCIAL SECURITY NUMBER

5. NAME *(Last, First, Middle Initial)*

6. DATE OF BIRTH

7. SEX

M - MALE, F - FEMALE

8. PAY GRADE UNIFORMED SERVICES

9. PAY GRADE CIVILIAN

10. SERVICE DUTY OCCUPATION CODE

11. MAILING ADDRESS OF ASSIGNMENT

FT RUCKER AL 36362

12. LOCATION - PLACE OF WORK

13. MAJOR COMMAND: TRADOC

14. DUTY TELEPHONE *(Include area code)*

15. AUDIOMETRY: 2

a. PURPOSE: 1 - 90 DAY, 2 - ANNUAL, 3 - TERMINATION, 4 - OTHER

AUDIOMETRIC DATA RE: ANSI S3.6 - 1969	LEFT						RIGHT					
	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
b. CURRENT AUDIOGRAM DATE 1999/11/12	25	50	65	45	100	90	45	45	55	35	25	55
c. REFERENCE AUDIOGRAM DATE 1997/04/13	10M	10M	15M	15M	10M	5M	15M	15M	15M	10M	10M	10M

d. SIGNIFICANT THRESHOLD SHIFT (STS): 2+ (1 - NO, 2 - YES)

e. THRESHOLD SHIFT ---------->

f. REMARKS *(Include Exposure Data)*

Routinely Noise Exposed, See IH Report for Noise Levels, H-1, Positive STS, I am aware of a change in my hearing and the need to return for further follow-up, Signature

_____

g. TYPE OF PERSONAL HEARING PROTECTION USED: 3

1 - SINGLE FLANGE (V51R), 2 - TRIPLE FLANGE, 3 - HAND FORMED EARPLUG, 4 - EAR CANAL CAPS, 5 - NOISE MUFFS, 6 - OTHER, 7 - NONE

Audiogram Irregularities

- **HEARS** can detect audiogram irregularities
- Will show up on the audiogram

QUESTIONS ???

Noise in Army Aircraft
(General Findings)

- Overall noise levels are equal to or exceed 100 dB's
- Most intense noise below 300 Hz
- Low frequency noise will produce high frequency hearing loss

Must Use Hearing Protection!

FIXED-WING AIRCRAFT NOISE

Noise in Army Fixed-Wing Aircraft

- Engines and propellers in close proximity to the cockpit
- Other fixed-wing aircraft are better insulated to attenuate noise levels

C-12 **106 dB**

*** Climb, 1900 RPM, 2000 MSL**

UC-35 (Cessna Citation Ultra)

Take Off	**85.2**	**dB**
Maximum	**95.9**	**dB**
Approach	**85**	**dB**

Rotary-Wing Aircraft Noise

Rotary-Wing Aircraft Noise

- Noise levels equal or exceed 100 dB
- Originates from engines, rotor systems and transmissions
- Observation helicopters
- Attack helicopters
- Utility and cargo helicopters

Rotary-Wing Aircraft Noise Levels

AIRCRAFT	dB
UH-1H	102
AH-1	105
OH-58C	103
OH-58D	104
CH-47D	112
UH-60A	108
AH-64	104
*TH-67	102
*Based on a Bell 206	

Noise During Air Load Operations

Aircraft	Maximum Pilot-Cruise	
C-5A	107 dB	85 dB
C-141	94 dB	84 dB
C-130	95 dB	84 dB
C-17	95 dB	88 dB

Crewmembers are exposed to noise levels that exceed 85 dB

Wear Hearing Protection !

QUESTIONS ???

ELO #7

- ACTION: Select the most practical and economical method of noise reduction available to aircrew members.
- CONDITION: From a list.
- STANDARD: IAW FM 3-04.301 (FM 1-301) and DA PAM 40-501.

Noise Protection

- Design
  Silent operation
  Noise suppression
- Isolate-distance
- Enclose

* Personal protective measures

* Most economical

Ear Plugs

- Foam, single flange, and triple flange
- Inexpensive , easy to carry
- Attenuation 18 to 45 dB across frequency band, if worn properly
- Effective when worn with SPH-4,SPH-4B, HGU-56, and IHU / IHADSS flight helmets

Ear Muffs

- 10 to 41 dB attenuation across the frequency band
- Comfortable to wear
- Ground personnel can lose their hearing too

Headsets

- Hearing protection as well as radio communication
- Attenuation could decrease due to damaged ear seals
- Commonly worn on VIP aircraft

Protective Helmets
(Characteristics)

- Provide both crash and noise attenuation
- Great protection against higher frequencies, however, low frequencies is the concern in the aviation environment.

Protective Helmets Guidelines

- Must fit properly, worn correctly
- Ear cups must be soft, unwrinkled, and tear free
- Noise attenuation will bring the noise exposure within the confines of damage risk criteria for every aircraft **Except UH-60 and CH-47**

Effective Exposure Levels

Protective Helmets / Headsets

Aircraft	Hearing Protector	Effective Exposure Level
AH-1	HGU-56	77
	SPH-4B	77.4
	SPH-4	83.2
UH-1H	HGU-56	81.3
	SPH-4B	81.3
	SPH-4	85.9
OH-58D	HGU-56	81.6
	SPH-4B	81.5
	SPH-4	86.3
OH-58C	HGU-56	76.9
	SPH-4B	76.8
	SPH-4	81.4
UH-60A	HGU-56	90.6
	SPH-4B	90.6
	SPH-4	95.1
CH-47D	HGU-56	86.8
	SPH-4B	88
	SPH-4	93.4
AH-64	IHADDS (R)	80.2
	IHADDS (XL)	83.5
C-12	H-157	70.5

Protective Helmets and Ear Plugs

- If worn in combination, will provide additional

protection from, All Aircraft Noise in the Army Inventory

Protective Helmets and Ear Plugs

Protector	UH-60A	CH-47D	AH-1S	OH-58	UH-1H
	120 kn	100 kn	100 kn	100 kn	100 kn
SPH-4 w/ triple flange	72.6	77.5	70.2	65.7	70.7
SPH-4 w/ single flange	75.3	78.4	71.5	67.4	71.9
SPH-4 w/ foam	70.4	77.3	68.8	63.5	68.8

New Hearing Protection

Communication Ear Plug (CEP)

QUESTIONS ???

Non-Occupational Noise Exposure

- General aviation flying
- Weapons firing
- Moonlighting
- Contemporary music
- Hobbies & recreation
- Household chores

Non-Occupational Noise Exposure Levels

Single engine aircraft	90 dB
Shotgun	130 dB
Bartending	95 - 110 dB
Music at the club	130 dB
Lawn mowers	95 -100 dB
Vacuum cleaners	95 - 100 dB

QUESTIONS ???

One last thing: Hearing protection devices are here for a reason, so wear them and enforce others to wear them.

SUMMARY

CONCLUSION